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### (54) Washing machine with storage reservoirs.

(57) Clothes washing or dishwashing machine, in particular of the household type, provided with a tub containing the washload and into which the wash liquor and possibly the rinse water is filled, and provided as well with a plurality of reservoirs (1,2,3) serving different purposes, but particularly adapted to recover, store and return to further use the liquor used during the various phases of a washing process.

When said liquor is poured off from a reservoir into the next one, possibly under provision of a treatment process therebetween for the same liquor, said liquor takes up in all cases the same physical volume. As a consequence, if said liquor is contained in corresponding adjoining reservoirs (2,3) having movable walls, it ensues that said reservoirs take up a total space which is considerably smaller than the space taken up by corresponding reservoirs of a traditional type.

Said reservoirs (2,3) are preferably of a bag-like, flexible type and are housed in a rigid, constant-volume container (1), said container being arranged inside the outer housing of the washing machine.

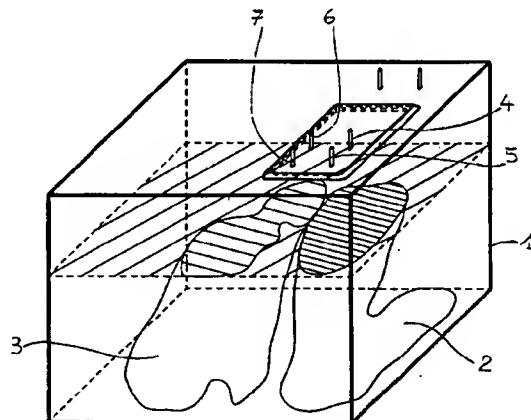


FIG. 2

**EP 0 546 348 A1**

The present invention relates to clothes washing or dishwashing machines of a particular type, intended in particular for home use, provided with one or more reservoirs for holding liquids, particularly liquids recovered from the washing cycle for recycling and further use.

Washing machines are known in the prior art, which comprise a plurality of reservoirs designed to different purposes; for instance, the Italian patent application no. 45716/A/90 describes a plurality of liquor reservoirs, said reservoirs being arranged inside the washing machine and being further adapted to both hold the different liquid means to be used in the washing process and contain the water that is recovered from some of the phases of the same washing process, in particular from the rinsing phases, in view of it being recycled for further use in the washing phase of the subsequent washing process.

The Italian patent application no. 45743/A/90 describes a method for filtering and recovering the washing liquor, consisting in the application of the physical process of reverse osmosis to clarify the liquor discharged by the washing machine, typically during the rinse cycles, in view of its further use. At least two reservoirs, for holding the liquor as recovered and after clarification, respectively, are used in the process.

It will be easily appreciated that these two reservoirs, which should have a volume of approx. 15 to 20 litres each, take up considerable room within the housing of the washing machine, where this room is by no way available normally, not even if such measures and solutions as indicated in the first one of the afore cited patent applications were implemented.

A fairly recent manner proposed to solve this problem calls for the implementation of solutions providing for the arrangement of said reservoirs in special containers provided on the outside of the washing machine. However, as anyone skilled in the art is well aware of, such a solution would not be easily accepted by the consumer owing to obvious reasons of out-of-standard dimensions and excessive encumbrance, as well as economical reasons.

It would therefore be desirable, and it is actually the purpose of the present invention, to provide a clothes washing machine or a dishwashing machine which is provided with reservoirs having such features as to be able to accomplish the basic task of collecting, storing and delivering said recovered liquors, while taking up a minimum space and, anyway, a space which is actually available to such a purpose inside the washing machine, as well as to also ensure those simplicity, safety and economy advantages that are typically required in connection with any household appliance.

Now, according to the invention such an aim is substantially reached in exploiting a peculiarity connected with the utilization of said reservoirs and consisting in that they are filled and/or emptied alternately, in the sense that a reservoir is actually filled when the other one is empty or is being emptied, and vice-versa, or else they are able to pour the liquor from a reservoir into the other one, i.e. in the case where the physical amount of liquor used in the process is always the same, since it is the same liquor, in a unchanging amount, that is being poured from a reservoir into the other one during the cycle of operation of the machine.

Said reservoirs are embodied with the features as substantially described with particular reference to the appended claims.

For a better understanding, the invention will be further described by way of non-limiting example with reference to the accompanying drawings in

which:

- Figure 1 is a symbolic view showing a container and, outside this container, two reservoirs according to the present invention;
- Figure 2 is a schematical view of said two reservoirs inserted in said container;
- Figure 3 is a view showing a different embodiment of a container holding separate reservoirs according to the present invention.

The invention essentially consists in providing a first invention that accommodates one or more reservoirs internally, said reservoirs being mutually separated and capable of taking in variable volumes according to the actual amount of liquor being filled into them.

If reference is made to the Figures 1 and 2, the rigid, constant-volume container 1 can be noticed, whereas a plurality of reservoirs 2, 3, which are provided in the form of bags with collapsible, waterproof walls, are accommodated in that container 1.

Each one of said reservoirs 2, 3 is provided with its own separate liquor inlet and outlet conduits 4,5 and 6,7, respectively.

The shape and the size of said collapsible bag walls are such as to enable each reservoir to be inflated to such an external volume and shape that it can practically expand to almost fill up the whole volume of the rigid container 1, provided of course that the other reservoir is appropriately emptied in a corresponding way, whereby the functions of the two reservoirs shown in the cited Figures are in this way mutually exchanged.

It is of course possible that the largest volume to be reached by each one of said reservoirs be actually limited to the largest volume of liquor that is likely or planned to be filled in.

It is of course a pre-condition and a basic requirement that the operation of the washing machine be such as to ensure that said two reservoirs

are actually used in such a way that, when one of them is filled, the other one is totally or partially empty, and vice-versa. Under these conditions, the reservoir that is being filled will therefore gradually increase its outer volume and change its outer shape in such a way as to take up the space which is available inside said rigid container 1, said space being left available by the other reservoir which deflates and contracts in correspondence of the increasing volume of the other reservoir as the latter is filled.

What we have here is practically an "exchange" of volumes between the two reservoirs, ie. the reservoirs are able to exchange their volumes owing to said ability of their walls to take on such a shape as to enable the capacity of their respective reservoirs to decrease or increase within desired limits.

The afore cited pre-condition can of course be considered as being met if there is a transfer of liquor from a reservoir into the other one, such a transfer process being possibly adapted to include one or more treatment phases for the liquor to flow through, such as for instance a purifying treatment or the addition of some appropriate additive.

The present invention can of course have different embodiments with differing provisions.

As a matter of fact, a quite simpler embodiment of the invention may be seen in having a single variable-volume reservoir accommodated in the container 1. In such a case, the second reservoir would be constituted by the inner volume of the container 1 itself, less the volume taken up by said internal variable-volume reservoir.

In another embodiment shown in Figure 3, the two reservoirs 2a and 3a are provided inside a container 1a having the shape of a portion of a cylinder, with an upper horizontal plane face 8, a side and vertical plane face 9, and a curved face 10 in the shape of an arc of a circle.

The two reservoirs are separated by four walls which are defined as follows:

- a plane wall 11 rotating within said container as defined above and hinged along the horizontal axis 12 intersecting the vertical and horizontal faces, said plane wall extending up to a certain depth toward said arcuated face 10;
- a foldable and/or flexible wall 13 which joins the inner edge of said plane wall 11 with the lower edge 14 of said vertical face 9;
- a foldable and/or flexible wall 15 which sealingly joins a side edge 16 of said plane wall 11 with the corresponding vertical edge of said vertical face 9, said foldable wall 15 being closed along the corresponding side edge 13a of said foldable wall 13;

- a foldable and/or flexible wall 17 which is in full symmetry to and has the same characteristics as the afore cited wall 15, said wall 17 being arranged in the opposite position in front of said wall 15.

With such a constructional configuration, the reservoir 2a is defined by the just cited walls above, while the reservoir 3a is defined by the remaining inner volume of the container 1a which is not occupied by said reservoir 2a.

Following the explanations given above, it certainly is apparent to anyone skilled in the art that the mutual variation of the volumes of the two reservoirs 2a and 3a is achieved through the rotation of the plane wall 11 about its rotation axis at 12, said rotation causing the side walls 15 and 17, as well as the bottom wall 13 to correspondingly stretch out or fold up, as the case may be, whereas the separation between the two reservoirs never ceases to exist, although their shape and, above all, their volumes are altered correspondingly.

An improved embodiment of the present invention is given by the fact that, since the flexural strength of said three foldable and flexible walls 13, 15 and 17 can actually be very high for a very low pliability of the same walls, this can prevent the plane wall 11 from rotating spontaneously under the effect of the hydrostatic pressure building up against said walls.

In such a case it is advantageous to provide for the wall 11 to be rotated by letting its rotation axis at 12 be motor-driven through an appropriate device 18 to be shrink-fitted on said axis 12 so as it acts on the latter in a technically *per se* known way and it is further capable of being activated according to the need arising each time for changing the volumes of said reservoirs 2a and 3a when this is required by the process.

It will be appreciated that the afore cited embodiments of the present invention have been described and illustrated in the accompanying figures only by way of non-limiting example and may therefore be the subject of any modification considered to be appropriate, without departing from the scopes of the invention.

### Claims

1. Clothes washing or dishwashing machine, in particular of the household type, comprising a tub containing the washload and into which the wash liquor and possibly also the rinse water is filled, and comprising as well a plurality of reservoirs (2, 3) serving different purposes, but particularly adapted to recover, store and return to further use the liquor used during the various phases of the washing process, characterized in that said reservoirs (2, 3) are

housed inside a rigid, constant-volume container (1) arranged inside the outer housing of the machine, said reservoirs (2, 3) being separated from one another and capable of changing their volume depending on the actual amount of liquor being filled into them.

2. Clothes washing or dishwashing machine according to claim 1, characterized in that the shape and the size of the walls of said reservoirs are such as to enable each reservoir to take on such an outer volume and such an outer shape as to fill up almost the whole inner volume of said rigid container (1).

3. Clothes washing or dishwashing machine according to claim 1, characterized in that a reservoir (3a) is defined by the outer rigid container (1a), the inner volume of which is not occupied by the reservoir(s) (2a) contained in said rigid container (1a).

4. Clothes washing or dishwashing machine according to any of the preceding claims 1, 2 or 3, characterized in that the reservoirs are used in such a way that, when one of them is filled, the other ones are totally or partially empty so that the reservoir that is being filled gradually increases the volume it takes up within the space which is available inside said rigid container (1), said space being left available by the other reservoirs which reduce the volumes taken up by them in correspondence of the increasing volume of the other reservoir as the latter is filled.

5. Clothes washing or dishwashing machine according to any of the preceding claims, characterized in that said reservoirs (2, 3) are provided inside said container (1) in the form of bags, the walls of which are made of collapsible, waterproof material.

6. Clothes washing or dishwashing machine according to either claim 3 or 4, characterized in that said reservoirs (2a, 3a) are provided inside a container (1) being in the shape of a portion of a cylinder, with an upper horizontal plane face (8), a side and vertical plane face (9), and an arcuated face (10) in the shape of an arc of a circle, said reservoirs being separated by four walls which are defined as follows:

- a wall (11) rotatably arranged within said container as defined above, and hinged about the horizontal axis (12) intersecting the vertical and horizontal faces, said plane wall extending up to a certain

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depth towards said arcuated face (10);

- a foldable and/or flexible wall (13) which joins the inner edge of said plane wall (11) with the lower edge (14) of said vertical face (9);
- a foldable and/or flexible wall (15) which sealingly joins a side edge (16) of said plane wall (11) with the corresponding vertical edge of said vertical face (9), said foldable wall (15) being closed along the corresponding side edge (13a) of said foldable wall (13);
- a foldable and/or flexible wall (17) which is in full symmetry to and has the same characteristics as the afore cited wall (15), said wall (17) being arranged in the opposite position in front of said wall (15).

7. Clothes washing or dishwashing machine according to claim 6, characterized in that said rotation axis (12) of said rotating plane wall (11) is mechanically or power driven through an appropriate device (18).

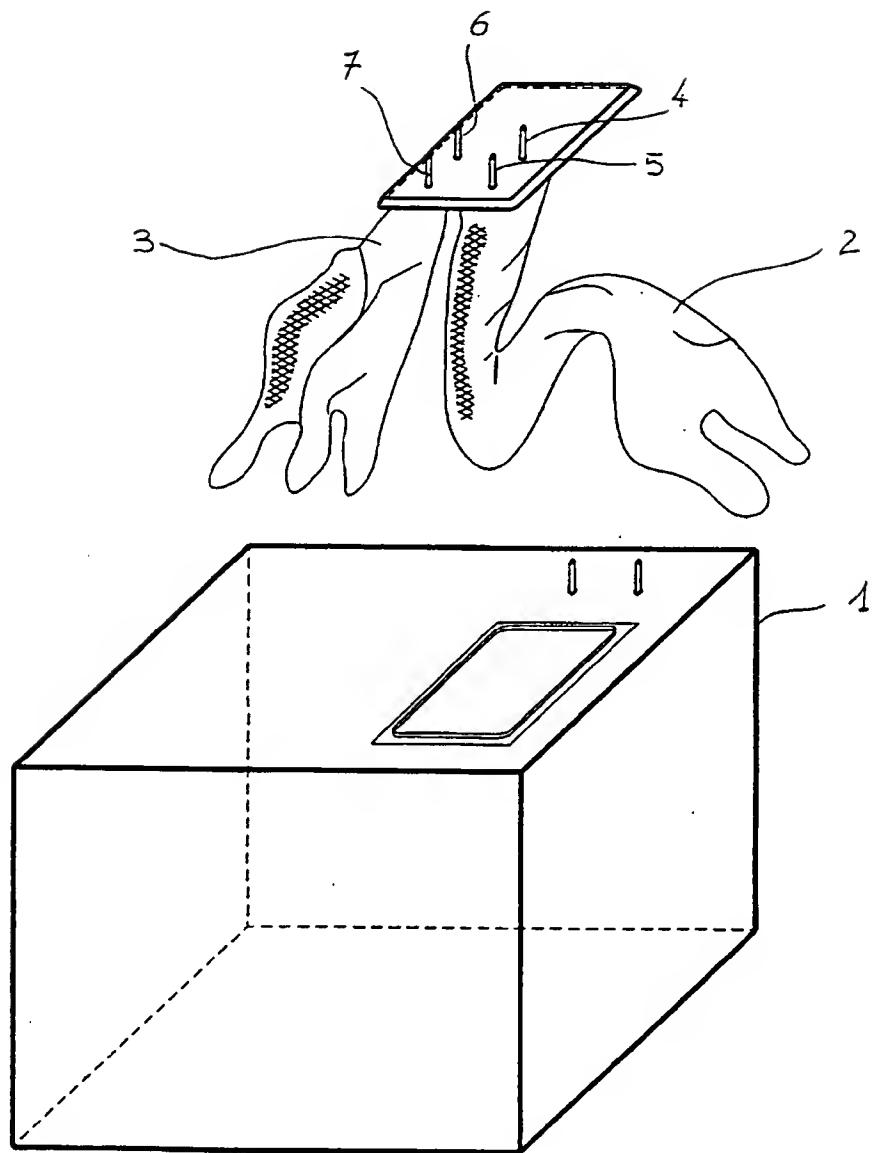


FIG. 1

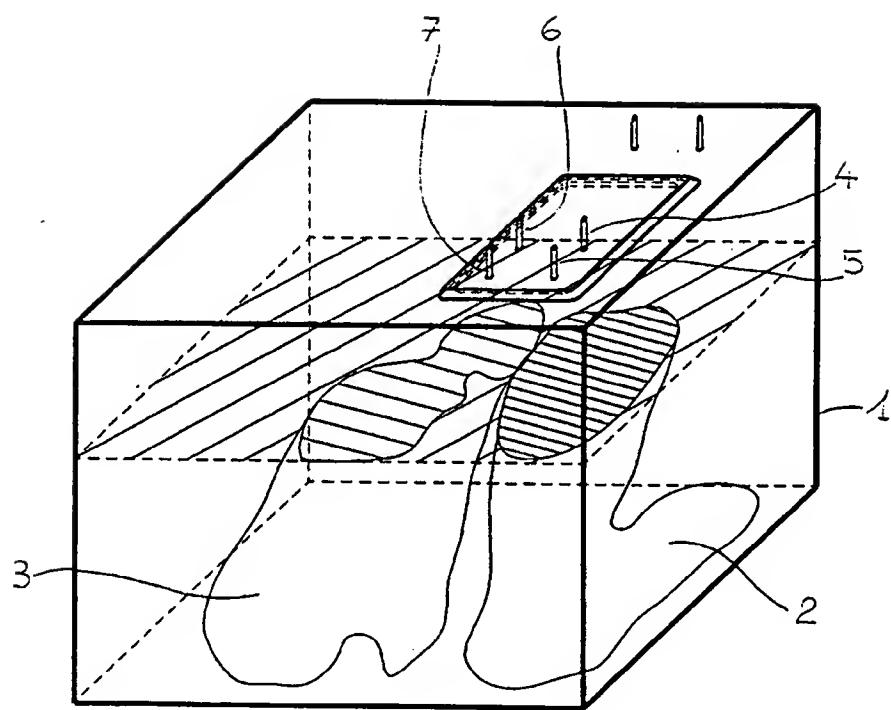


FIG. 2

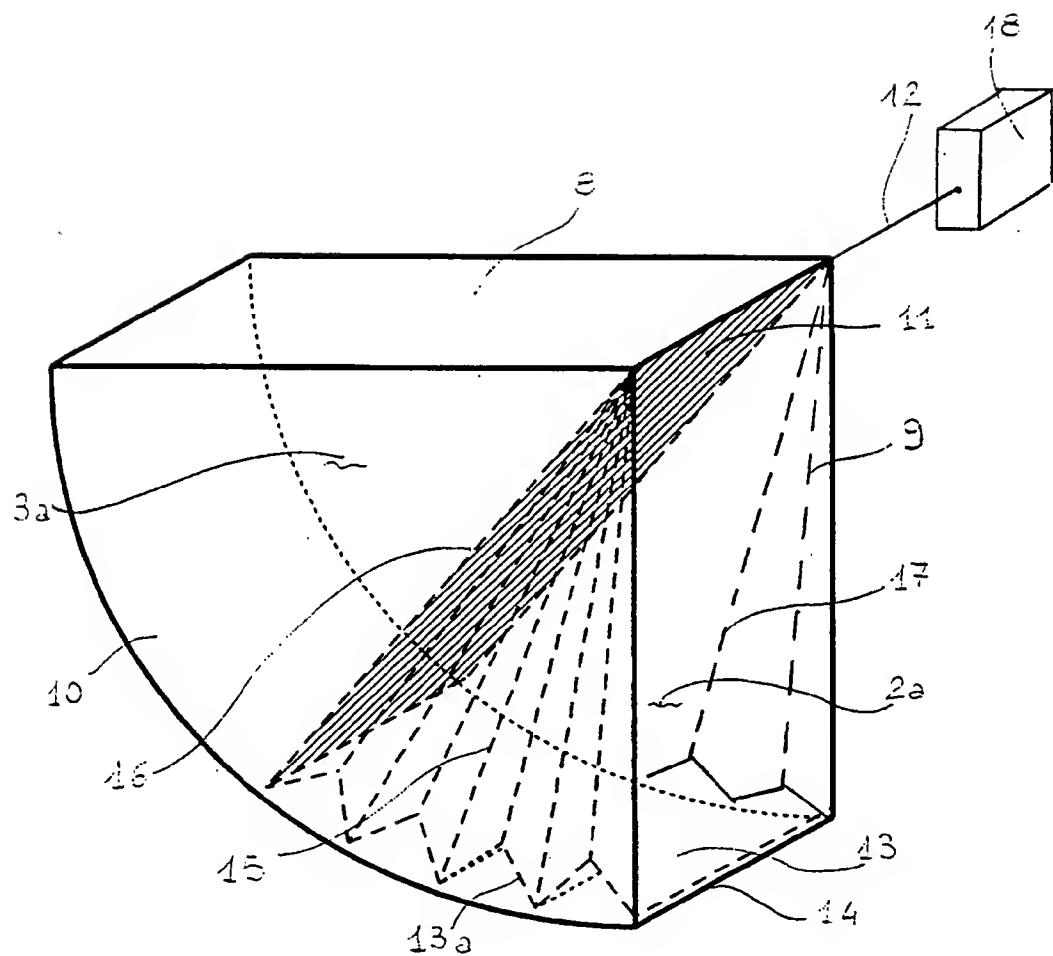


FIG. 3



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## EUROPEAN SEARCH REPORT

Application Number

EP 92 11 9524

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	DE-U-8 716 514 (J. HENTSCHEL) * page 1, line 24 - page 2, line 31; figures *	1-4	D06F39/00 B65D88/62
A	WO-A-8 103 011 (M.R.A. MOREAU) * claims 1-3; figures 2,3 *	1-3,5	
A	US-A-3 421 661 (ARDE INC.) * abstract; figures *	1-3,6,7	
A	DE-A-3 513 939 (INSTITUT FÜR KOMMUNALWIRTSCHAFT) * claims; figure *	1	
A,D	EP-A-0 449 060 (INDUSTRIE ZANUSSI S.P.A.) * abstract; figure 1 *	1	
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			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			D06F B65D
<p>The present search report has been drawn up for all claims</p>			
Place of search	Date of completion of the search	Name of the examining division	
THE HAGUE	29 MARCH 1993	COURRIER G.L.A.	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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